User Manual

Embsec IPA

I/O controller designed for IP systems

EMBSEC

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1. Introduction

Embsec IPA is a network based I/O device that connects to your surveillance system. IPA allows you to monitor and control alarm sensors, measurement devices, sirens, gates and lights, and integrate connected units to your VMS system or to allow direct control of network cameras.

1.1. Features

Field of application	Convert signals from alarm sensors or measurement devices to network alarms. Activate units through network alarms. Powering connected devices.
Digital input	4x digital inputs, *high / low / rising edge / falling edge / frequency counting*
Analog input	1x 4-20 mA or 0-10V
Alarm output	3x relay. Max 30V, 200mA. NC and NO
Power output	1x 12V DC, max 1A or 24V DC, max 0.5A
Network alarms	User configurable HTTP web requests
Power supply	Power over Ethernet (48V DC)
Power consumption	Max 12W, PoE class 3
Operating temperature	- 30°C to + 60°C
Interface	Ethernet IEEE 802.3af, TCP/IP. Web browser user interface
Mounting	4 x M6 (80x155mm), DIN-rail or mounting screws
Enclosure rating	IP66
Color	Black
Weight	0.6 kg

1.2. Electrical specifications

Power output	12 VDC, max 1 A or 24 VDC, max 0.5 A. Short circuit protection.
Analog input	0-10 V: Accuracy: +/- 25 mV, 12-bit resolution. 4-20 mA: Accuracy: +/- 0.05 mA, 12-bit resolution. Choose input type with DIP-switch.
Digital input	Max 24 V. *Low* signal voltage: 0-1 V. *High* signal voltage: 5-24 V. Current typ. 4.4 mA @ 24 V. Frequency counting: 0.2 Hz-2.5 kHz. Frequency accuracy < 1 %.
Digital output	Relay, max 30 V, 200 mA. NC and NO.

1.3. Before operation

The Embsec IPA I/O controller is designed to be intuitive and easy to use, but to ensure best performance all users of the unit should carefully read this instruction manual before use.

This manual uses the following warning indications to provide information regarding usage of the product to prevent you and others from being harmed and your assets from being damaged. These warning indications are described below. Ensure you understand these precautions before proceeding with the installation.

⚠ Warning	Failure to follow the instructions provided by this warning and improper handling may cause death or serious injury.
⚠ Caution	Failure to follow the instructions provided by this caution and improper handling may cause injury and/or property damage.

This symbol indicates prohibition. The specific prohibited action is provided in and/or around the figure.

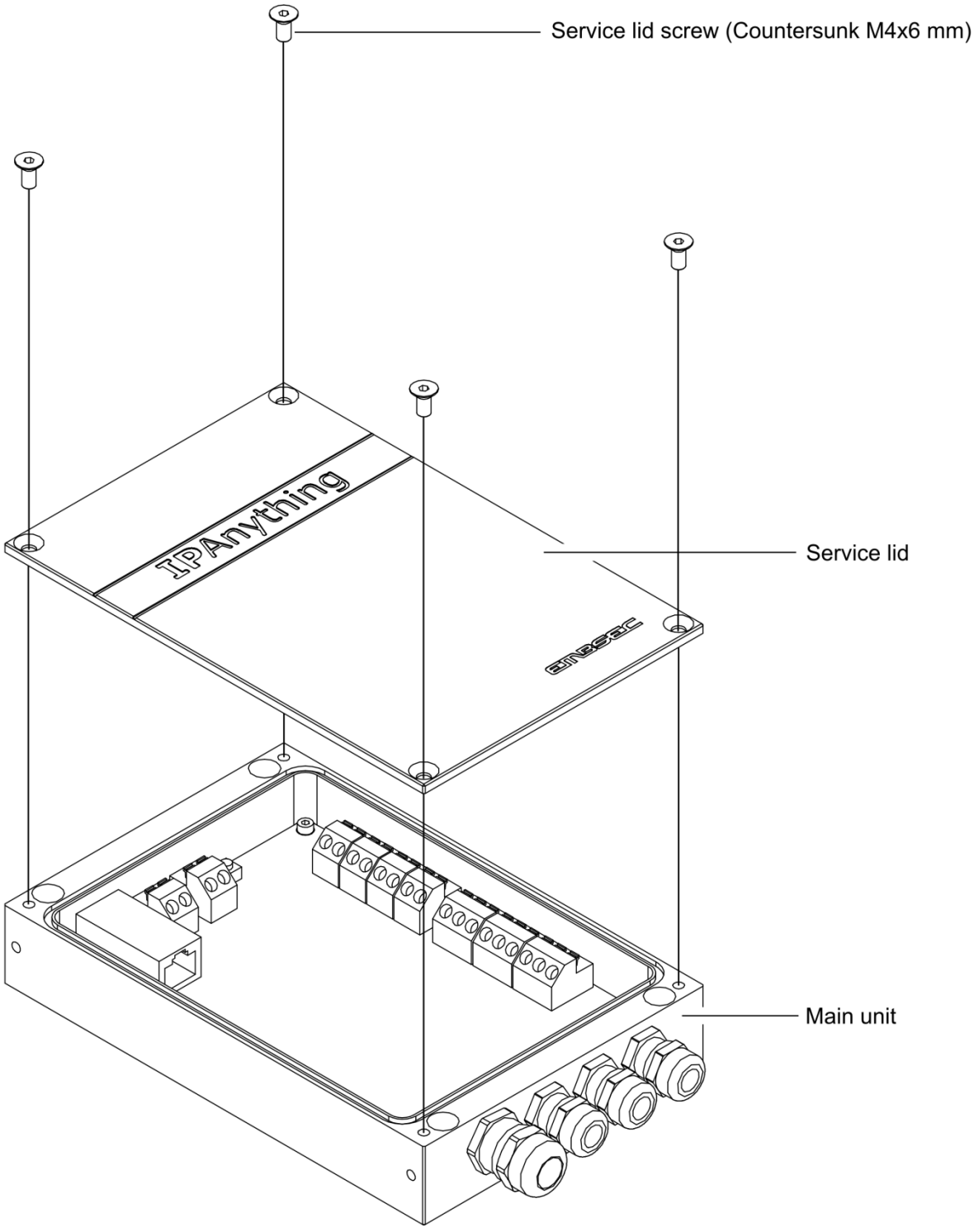
This symbol requires an action or gives an instruction.

⚠ Warning	
Never attempt to disassemble or repair the product. It may cause fire or damage to the devices.	
Hold the main unit securely when you install or service it. Exercise care not to bump the product against nearby objects or drop it inadvertently.	
⚠ Caution	
Ensure the DIP-switches are in correct position for desired power output voltage and analog input type before powering on the IPA.	
Only use approved Power over Ethernet power supplies. Never try to power the device in other ways than with the RJ45 PoE connection.	
Do not touch the unit connections with a wet hand or when the product is wet with rain. It may cause short circuit and damage the unit.	
Clean and check the product periodically for safe use. If any problem is found, contact Embsec or authorized partner to solve the issue before continue using the product.	
This product is intended to detect intruders and is not designed to prevent theft, disasters or accidents. The manufacturer shall not be held liable for any damage to user's property resulting from theft, disasters or accidents.	

1.4. Precautions

- Make sure the power consumption of connected devices are below the maximum output power of the IPA.
- Do not install or leave the product in a location exposed to heat, vibrations or impacts.

1.5. Part identification



2. General applications

2.1. Integrate alarm sensors

Embsec IPA has a 12V socket to power connected alarm sensor and four digital alarm inputs. Each input can be used to create network alarms directly to VMS, IP cameras or other network devices. Let your line detectors, IR sensors, micro wave barriers, fence alarms or buried sensors be truly integrated parts in your video surveillance system. With the unit connected to an IPA, installation and integration is just as easy as with IP cameras.

2.2. Control equipment

Allow sirens, warning lights and lighting to be controlled over the network, either from your VMS system, from other devices or from sensors connected to the IPA. Three relay outputs offer the option of controlling multiple devices or to control devices with separate on and off signals.

With the 12V socket, devices with low power consumption, such as sirens and warning lights, can be powered directly by the IPA.

2.3. Add measurement devices

Find new possibilities in the borderland between measurement and surveillance. With the analog input and the possibility to measure pulse frequency on the digital inputs, it is possible to connect almost any type of measurement sensor to the IPA. This allows to easily create network alarms from the measurement sensors based on thresholds and time parameters. Let for example a level sensor activate camera recording or present a measurement value as text overlay directly in the camera.

The IPA can be used to create simple IP measurement solutions with only a sensor connected to the IPA and a camera, but it can as well be used in large-scale industrial applications where critical parts of the process have monitoring cameras connected to a VMS.

3. Installation

3.1. Mount the unit

3.1.1. Mount on sheet metal

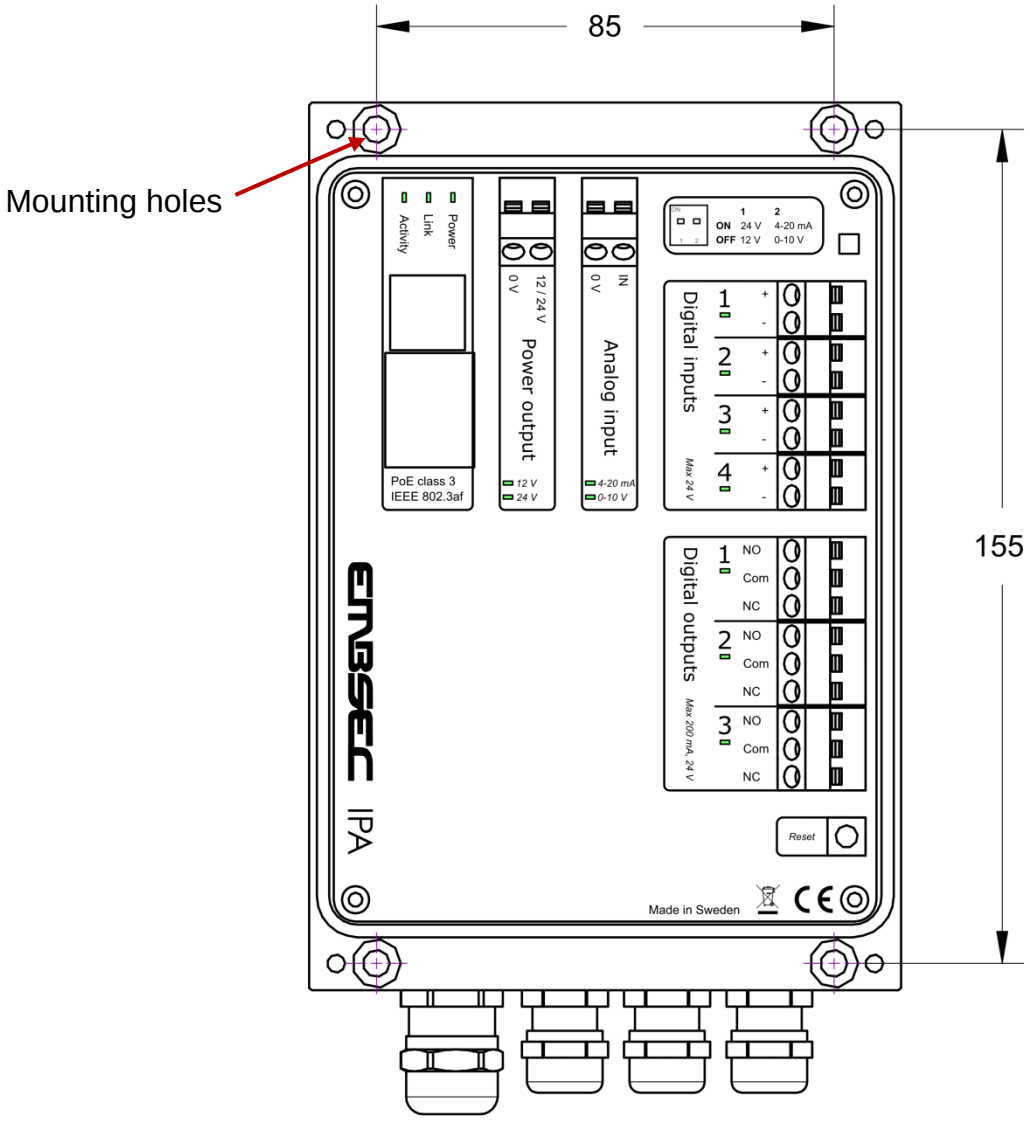
Use the four threaded M6 holes in the main unit. The holes are placed with the centers at 80x155 mm.

3.1.2. Mount on walls etc

Most types of screws can be used. Make sure the screw head fits in the counterbore. If the service lid doesn't fit properly the unit will not be waterproof.

3.1.3. Mount on DIN rail

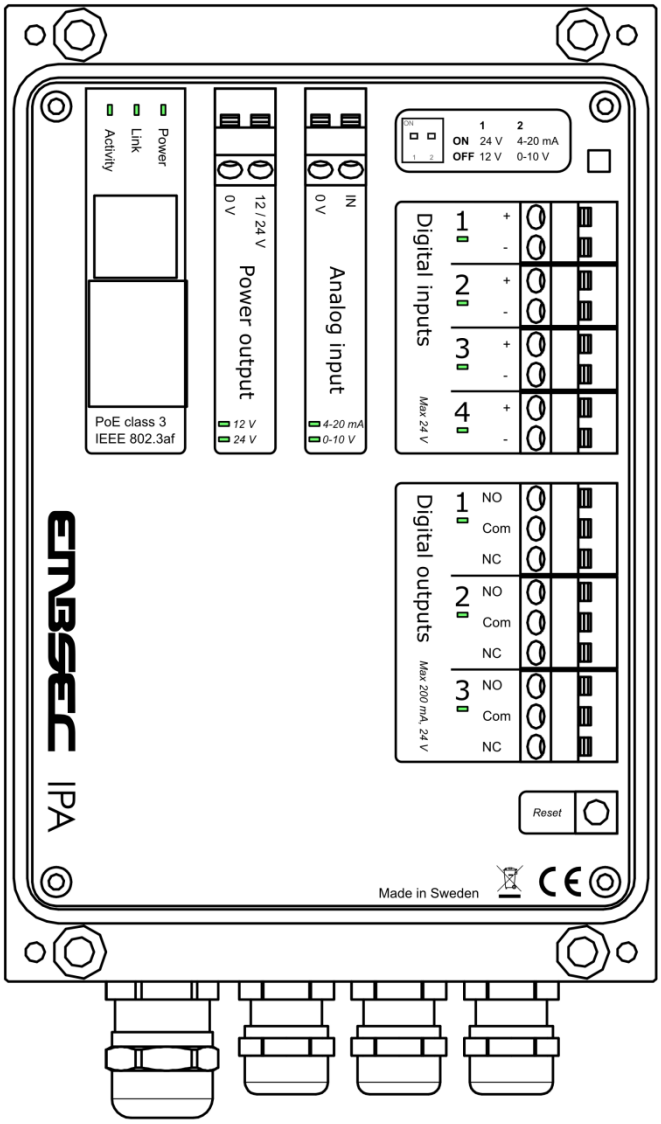
It is possible to stack the units on DIN rails. Use the optional DIN mount accessory, which is mounted on the side of the main unit.



3.2. Electric installation

3.2.2 General connection

1. Remove the service lid (please refer to section 1.5.)
2. Insert the network cable without a connector through the large cable gland.
3. Follow your connector assembly instruction to patch the network cable.
4. Connect the network cable and verify that the unit power up and that the network connection is working.
5. Unplug the network cable.
6. Connect devices to the IPA according to sections 3.2.3, 3.2.4, 3.2.5 and 3.2.6.
7. Plug in the network cable.
8. Refit the service lid.
9. Plug all cable glands that are not in use.



3.2.3. Powering external devices

Embsec IPA has a short circuit protection to prevent damage on the unit but users should always pay attention to avoid any connections that may cause short circuit or over load.

1. Make sure the external devices requires a power supply of 12V DC or 24V DC and that the total power consumption is less than 12W.
2. Set DIP-switch number 1 to "ON" if the devices requires 24V. Leave it at "OFF" it the devices requires 12V.
3. Connect the power cables to the "Power output" socket according to the markings on the IPA.
4. Connect the network cable and check that the external devices powers up.
5. Unplug the network cable and follow the instructions for sections 3.2.2, 3.2.3 and 3.2.4

3.2.4. Analog input

1. Set DIP-switch number 2 to "ON" to measure current (4-20 mA), and "OFF" to measure voltage (0-10 V).
2. Connect the signal cable to the "Analog input" socket according to the markings on the IPA.

3.2.5. Digital input

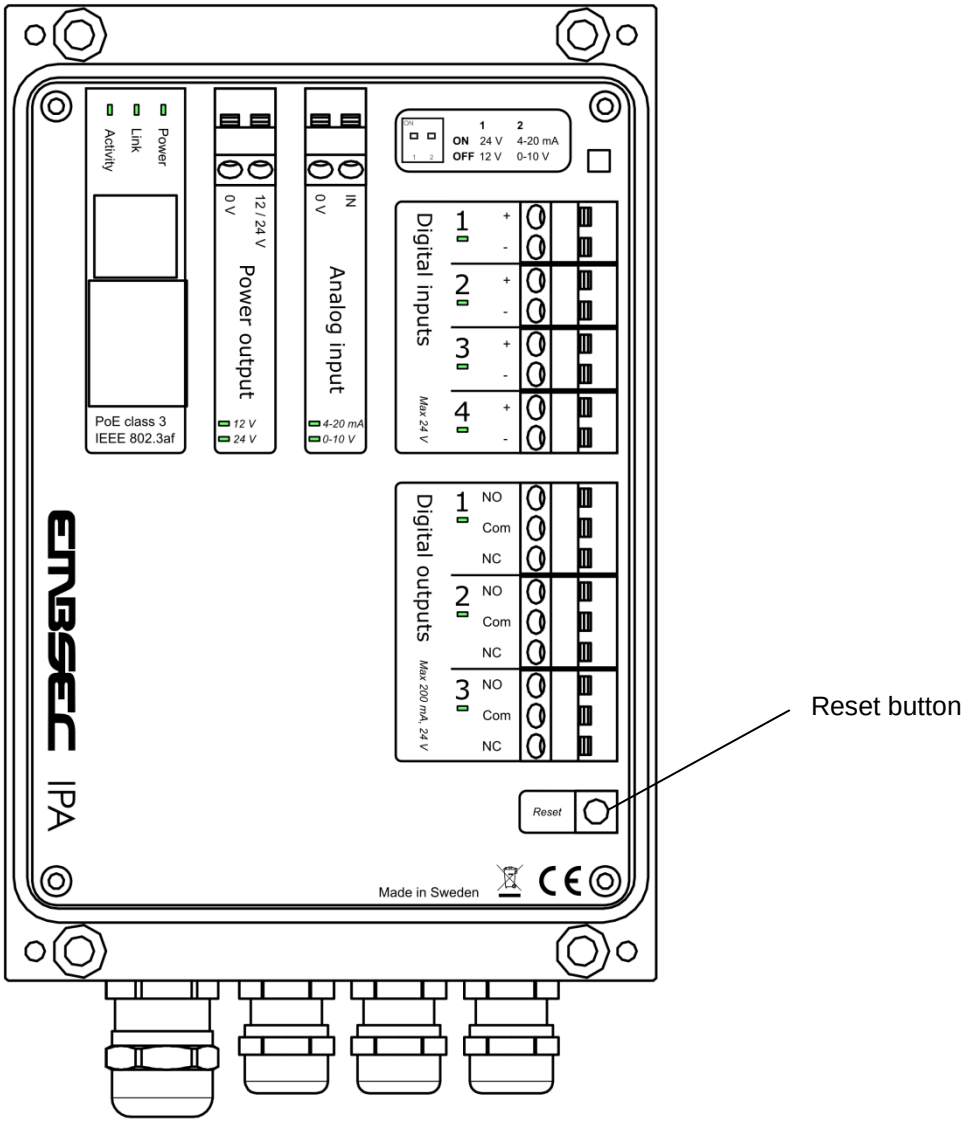
1. Make sure the signals complies with the following specification: Max 24V. "Low" signal voltage: 0-1V. "High" signal voltage: 5-24V. Current typ. 4.4mA@24V.
2. Connect the signal cables to the "Digital input" sockets according to the markings on the IPA. Up to 4 different digital inputs can be used.

3.2.6. Digital output

1. Make sure the connected device for each output complies with the following specification: Max 30V, 200mA.
2. Each digital output can be used as normally closed (NC) and normally open (NO).
3. Connect the cables to the "Digital output" sockets according to the markings on the IPA. Up to three relays can be used.

3.3. Factory reset

1. Remove the service lid.
2. Disconnect the network cable.
3. Press and hold the reset button, while reconnecting the network cable.
4. Refit the service lid and shell.
5. The unit will change IP address to default IP and login (see next page).
6. The unit will restart in the bootloader. Please refer to section 5.3.6.



4. API

4.1. HTTP requests

All HTTP requests are of the GET method. The HTTP requests are based on the following layout:

```
http://<user>:<pass>@<ip-address>/<product>/<group>/<index>/<function>/<action>
```

`<user>`	Saved username in the product
`<pass>`	Saved password in the product
`<ip-address>`	IP address of the product

4.1.1. IPA API function list

Product	Group	Index	Function	Action	Description
ipa					Returns all status of the IPA.
	digital_inputs				Returns status of all digital inputs
		1 ... 4			Returns status of selected digital input
			state		Returns state of selected digital input
			frequency		Returns frequency of selected digital input
	digital_outputs				Returns status of all digital outputs
		1 ... 3			Returns status of selected digital output
			state		Returns state of selected digital output
				open	Sets selected digital output to open.
				close	Sets selected digital output to closed.
	analog_inputs				Returns status of all analog inputs
		1			Returns status of selected analog input
			value		Returns the value of selected analog input
			unit		Returns the unit of selected analog input
	tampering				Returns status of all tampering sensors
		lid			Returns status of selected tampering sensor
			state		Returns state of selected tampering sensor
				reset	Resets the state of selected tampering sensor

4.1.2. Examples - Get status information

Each time a status is requested the IPA returns a JSON object. The JSON object is built up with the logic as described in section 4.1.1.

Get state of a specific digital input with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/digital_inputs/1/state`
Response: `"high"`

Get status of a specific digital input with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/digital_inputs/4`
Response: `{"state": "low", "frequency": 0}`

Get status of all digital inputs with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/digital_inputs`
Response:

```
{
        "1": {"state": "high", "frequency": 0},
        "2": {"state": "-", "frequency": 34.5},
        "3": {"state": "high", "frequency": 0},
        "4": {"state": "low", "frequency": 0}
}
```

Get the measured value from a specific analog input. The IPA returns a floating point number.

HTTP request: `http://user:pass@<product-ip>/ipa/analog_inputs/1/value`
Response: `5432.1`

Get the status of a specific analog input with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/analog_inputs/1`
Response: `{"value": 5432.1, "unit": "mm"}`

Get the status of a tampering sensor with the following request. Note that once a tampering sensor has indicated "alarm" it will not change back unless a reset command is send.

HTTP request: `http://user:pass@<product-ip>/ipa/tampering/lid`
Response: `{"state": "alarm"}`

4.1.3. Examples - Action commands

Close a specific digital output with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/digital_outputs/1/state/close`
Response: `OK`

Reset a specific tampering alarm with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa/tampering/lid/state/reset`
Response: `OK`

4.1.4. Example - full status

Get all status of the IPA with the following request.

HTTP request: `http://user:pass@<product-ip>/ipa`
Response:

```
{
    "digital_inputs": {
        "1": {
            "state": "high",
            "frequency": 0
        },
        "2": {
            "state": "-",
            "frequency": 34.5
        },
        "3": {
            "state": "high",
            "frequency": 0
        },
        "4": {
            "state": "low",
            "frequency": 0
        }
    },
    "digital_outputs": {
        "1": {
            "state": "closed"
        },
        "2": {
            "state": "open"
        },
        "3": {
            "state": "open"
        }
    },
    "analog_inputs": {
        "1": {
            "value": 5432.1,
            "unit": "mm"
        }
    },
    "tampering": {
        "lid": {
            "state": "no_alarm"
        }
    }
}
```

4.2. Modbus TCP

The internal Modbus TCP server/slave listens to TCP port 502 and is enabled by default. IPA Modbus TCP uses a 'big-endian' representation for addresses and data items.

4.2.2. IPA Modbus TCP register list

Hardware function	Description	Modbus Function (function code)	Address	Length
Digital input 1	Returns the status of IPA digital input 1	Read input discretes (2)	0	1-bit
Digital input 2	Returns the status of IPA digital input2	Read input discretes (2)	1	1-bit
Digital input 3	Returns the status of IPA digital input3	Read input discretes (2)	2	1-bit
Digital input 4	Returns the status of IPA digital input4	Read input discretes (2)	3	1-bit
Digital output 1	Returns status of selected output	Read Coil (1)	0	1-bit
	Set status of selected output	Write Single Coil (5)		
Digital output 2	Returns status of selected output	Read Coil (1)	1	1-bit
	Set status of selected output	Write Single Coil (5)		
Digital output 3	Returns status of selected output	Read Coil (1)	2	1-bit
	Set status of selected output	Write Single Coil (5)		
Tampering - Lid sensor	Returns status of tampering sensor	Read input discretes (2)	100	1-bit
	Reset status of tampering sensor	Write Single Coil (5)	100	1-bit
Digital input 1 frequency	Returns the frequency of the digital input 1	Read Input Registers (4)	0	32-bit IEEE-745 float
Digital input 2 frequency	Returns the frequency of the digital input 2	Read Input Registers (4)	2	32-bit IEEE-745 float
Digital input 3 frequency	Returns the frequency of the digital input 3	Read Input Registers (4)	4	32-bit IEEE-745 float
Digital input 4 frequency	Returns the frequency of the digital input 4	Read Input Registers (4)	6	32-bit IEEE-745 float
Analog input 1	Returns the raw value of IPA analog input	Read Input Registers (4)	100	16-bit
	Returns the Scaled value of IPA analog input	Read Input Registers (4)	101	32-bit IEEE-745 float

5. User interface

All settings are made through the web based user interface. This means there are no limits in hardware or software for using the systems, all that is needed is a modern web browser.

The instructions for the user interface described below are valid for firmware 1.1..

5.1. Factory default settings

When using the system for the first time, or if a factory reset has been made, the following settings are used.

Product IP number	192.168.0.10
Subnet mask	255.255.255.0
Default router	192.168.0.1
Username	admin
Password	admin

5.2. Login

1. Open a web browser
2. In the address field, type in the selected unit IP-address.
3. The user interface login page is shown.
4. Login with your username and password.

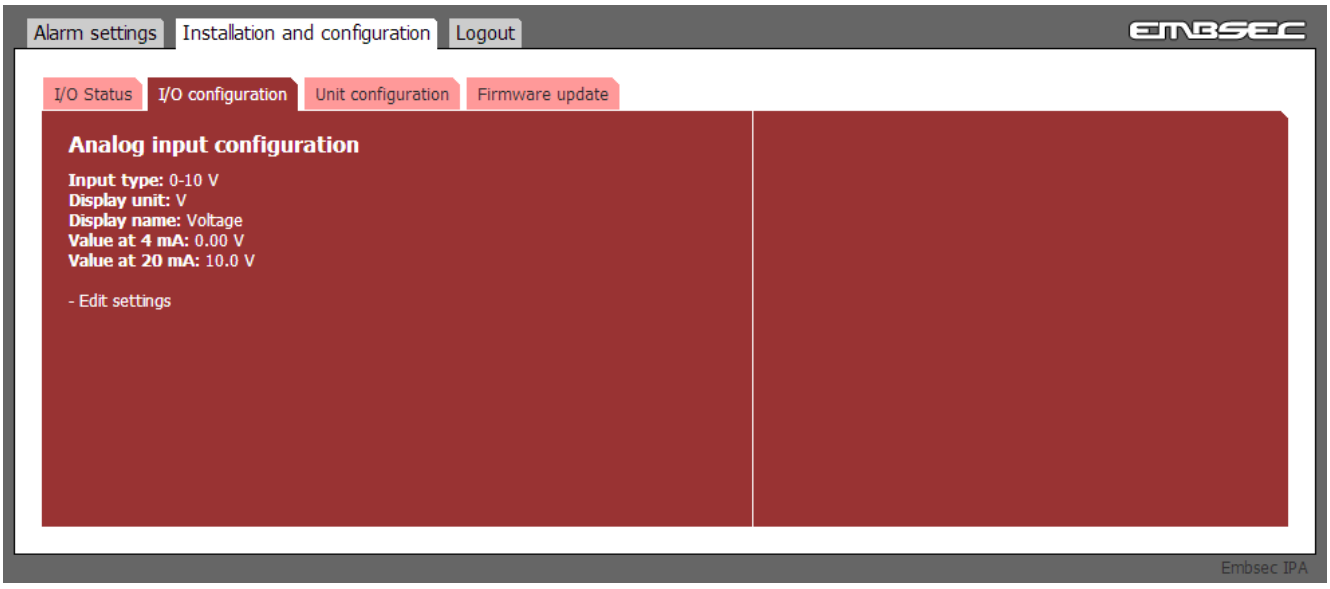
5.3. Installation and configuration

5.3.1. I/O Status

1. Open the *Installation and configuration* tab
2. The default sub-tab is the *I/O Status* window.
3. The diagram displays the analog input signal during the last 60 seconds.
4. To the right is a list with current digital inputs status, analog input value, tampering sensor status, digital outputs status (green indicates on), and buttons to manually control the digital outputs.

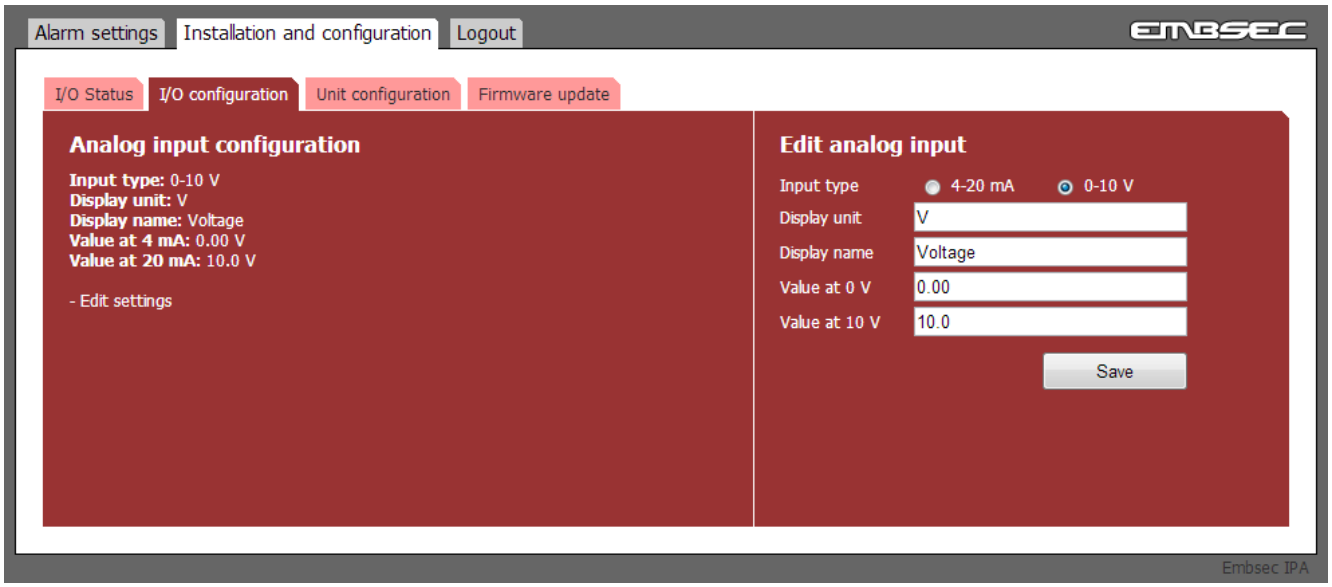
5.3.2. I/O Configuration

1. Open the *I/O Configuration* sub-tab.
2. Current settings are shown.
3. To change analog input settings, press *Edit settings*.



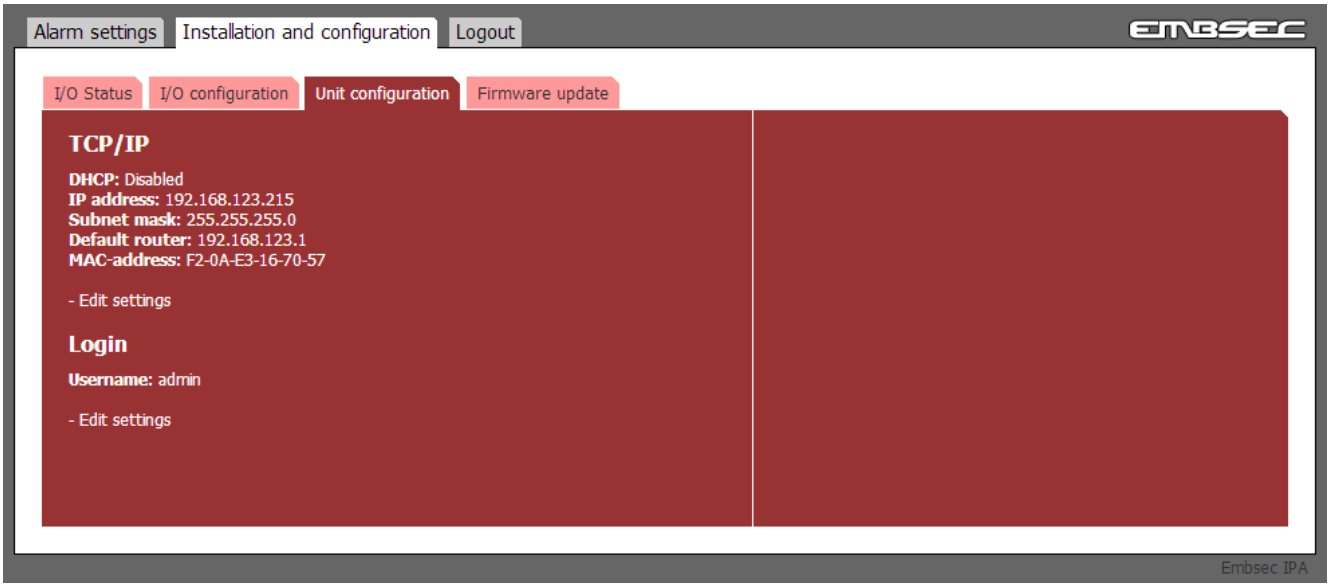
4. Select *Input type* to match your device.
5. Enter measurement unit and name, for example °C for temperature and kPa for pressure.

6. Enter measurement value at 0 V / 4 mA and 10 V / 20 mA. The IPA performs a linear interpolation to convert the measured voltage or current into your preferred unit. This allows to set alarms based on for example °C or kPa, which means more intuitive alarm settings.

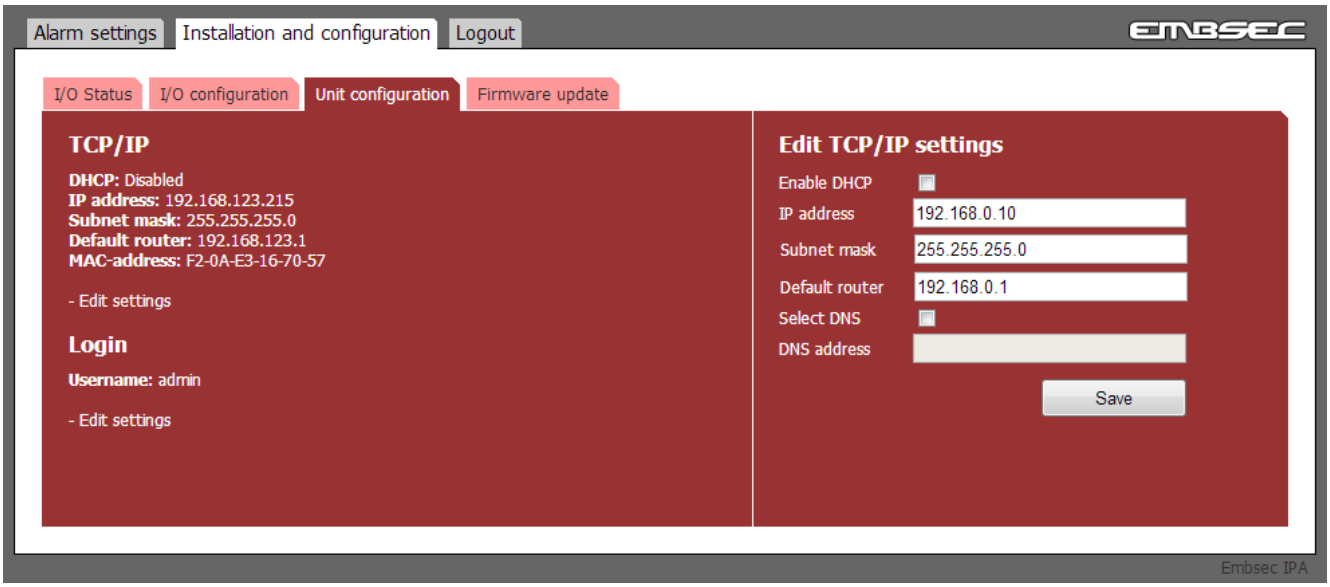


5.3.3. Unit configuration

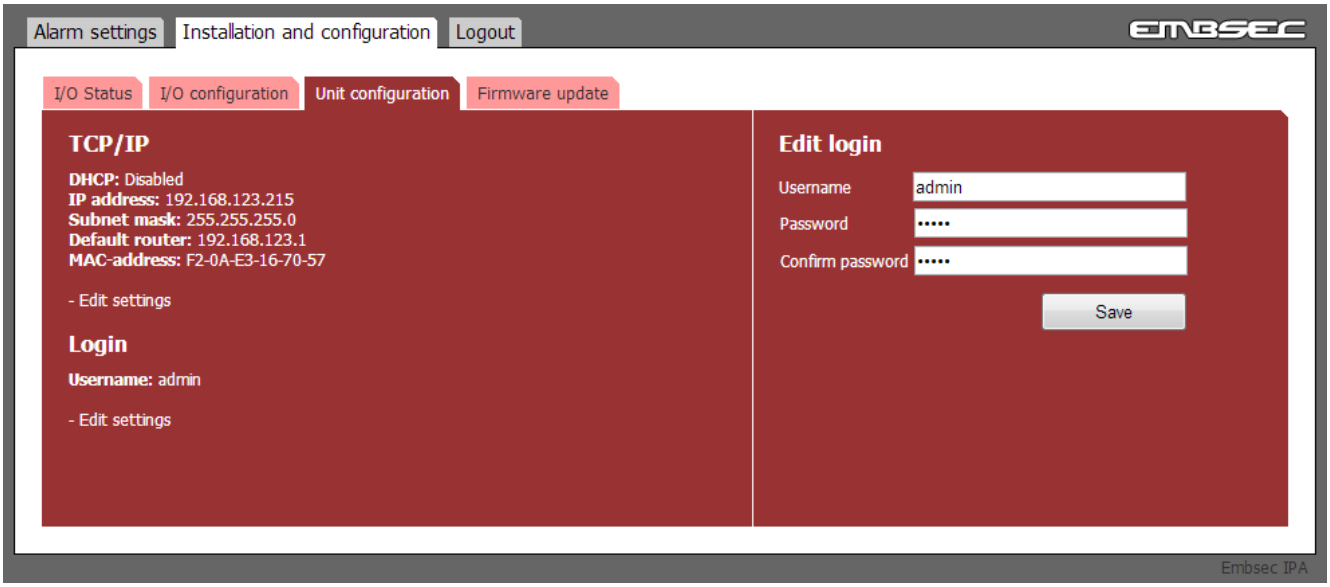
1. Open the sub-tab in the installation and configuration window.
2. Current settings are shown.



3. To change TCP/IP settings, press *Edit settings*. Input fields appear to the right.
4. Enter desired settings and press the save button. Remember to reload the page with the new IP address if changed.



5. To change Login settings, press *Edit settings*. Input fields appear to the right.
6. Enter a new username and password.
7. Press the save button to confirm.

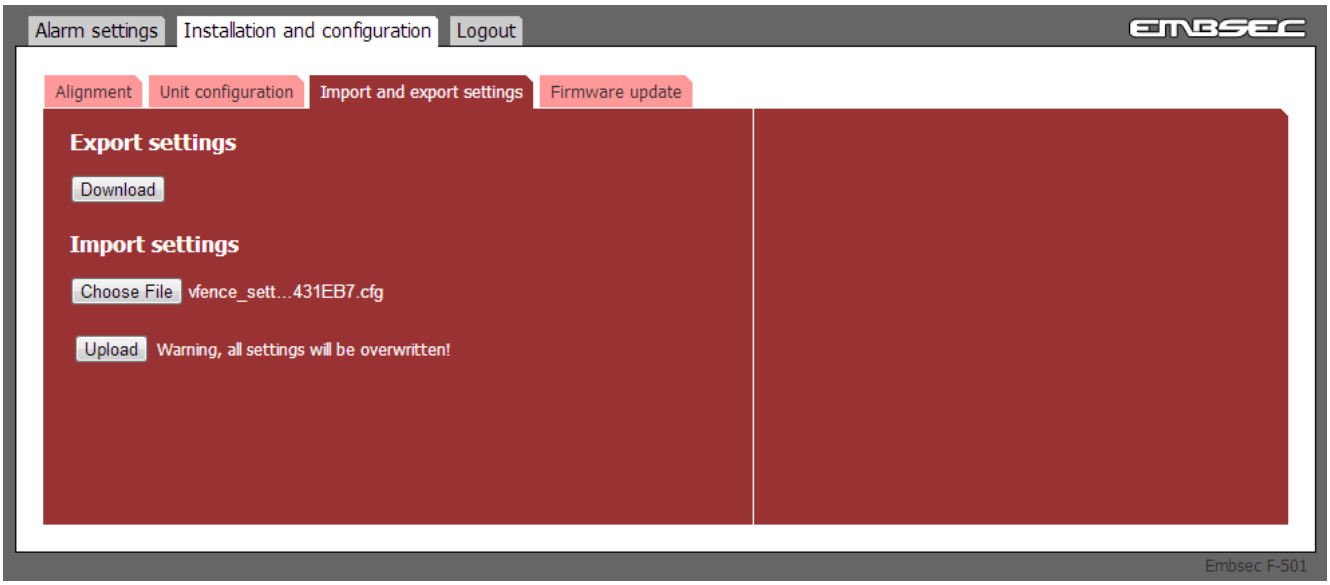


5.3.4. Import and export settings

Alarm settings and I/O configuration can be exported as a file for backup purposes and to copy the settings to other units. IP address and Login settings are not included in this file.

1. Open the *Import and export settings* sub-tab in the *Installation and configuration* tab.
2. Export all current alarm settings and I/O configuration by pressing the *Download* button. Pay attention to the file location on your hard drive. The file name is individual for each unit as it includes the unit MAC-address.

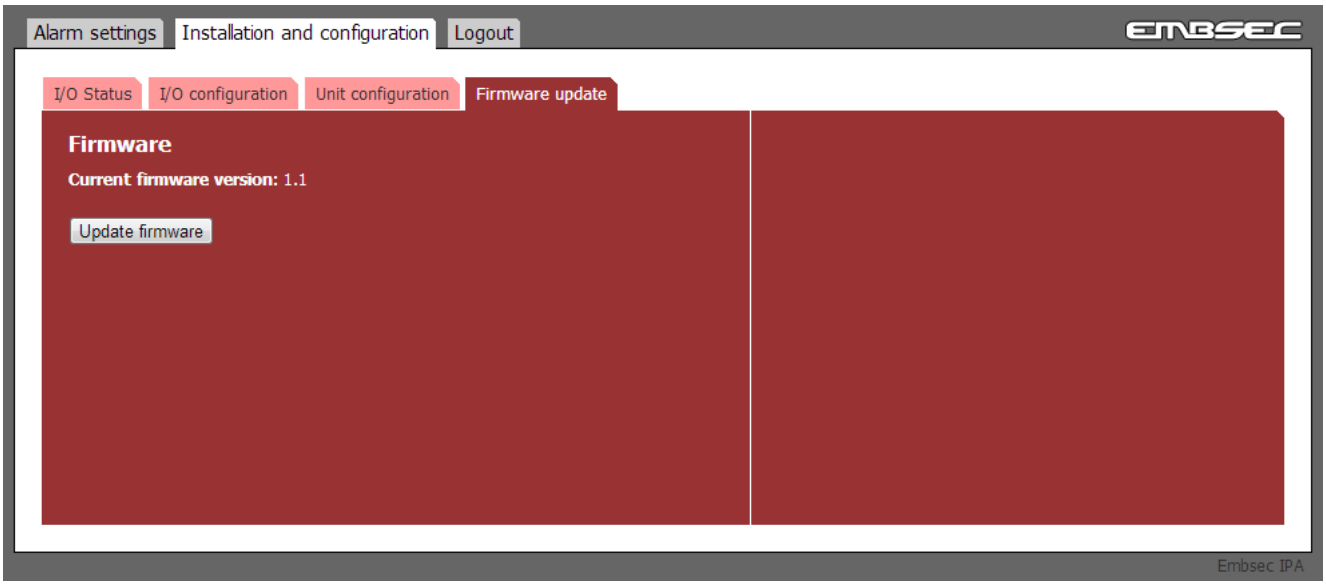
3. To import a setting file, press *Choose File* button and navigate to the location of your setting file on your hard drive.
4. When the file is selected it is possible to import it with the *Upload* button. Pay attention to the status message next to the button. Importing a setting file will overwrite all current settings.



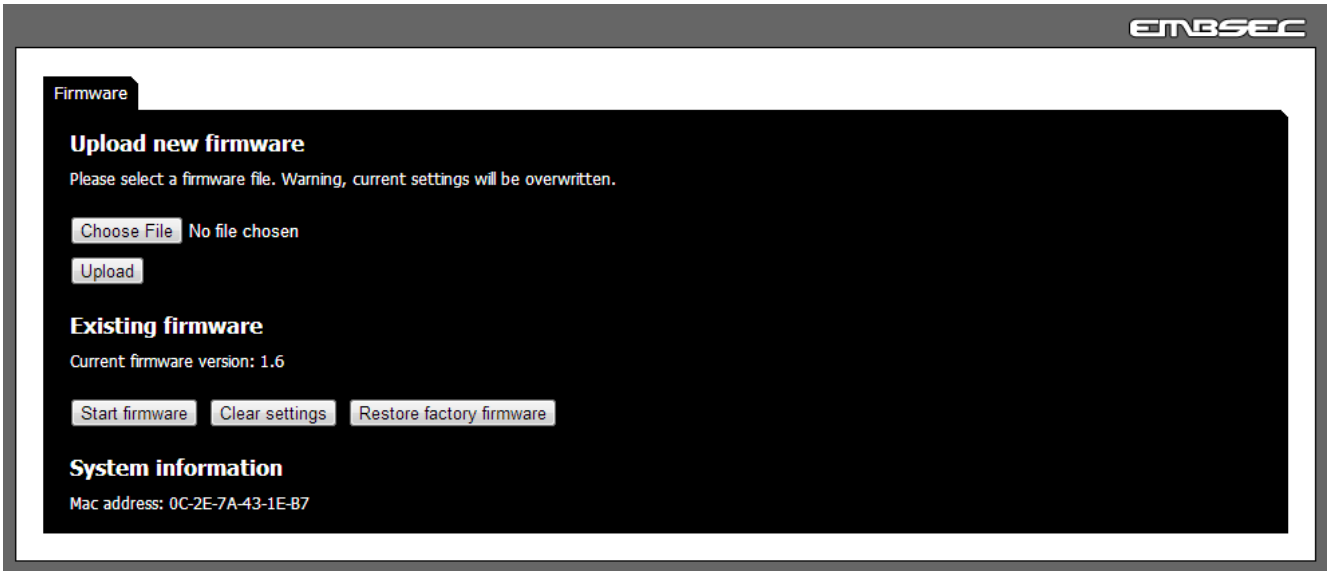
5.3.5. Firmware update

The IPA firmware can be updated to add new functions or resolve software issues.

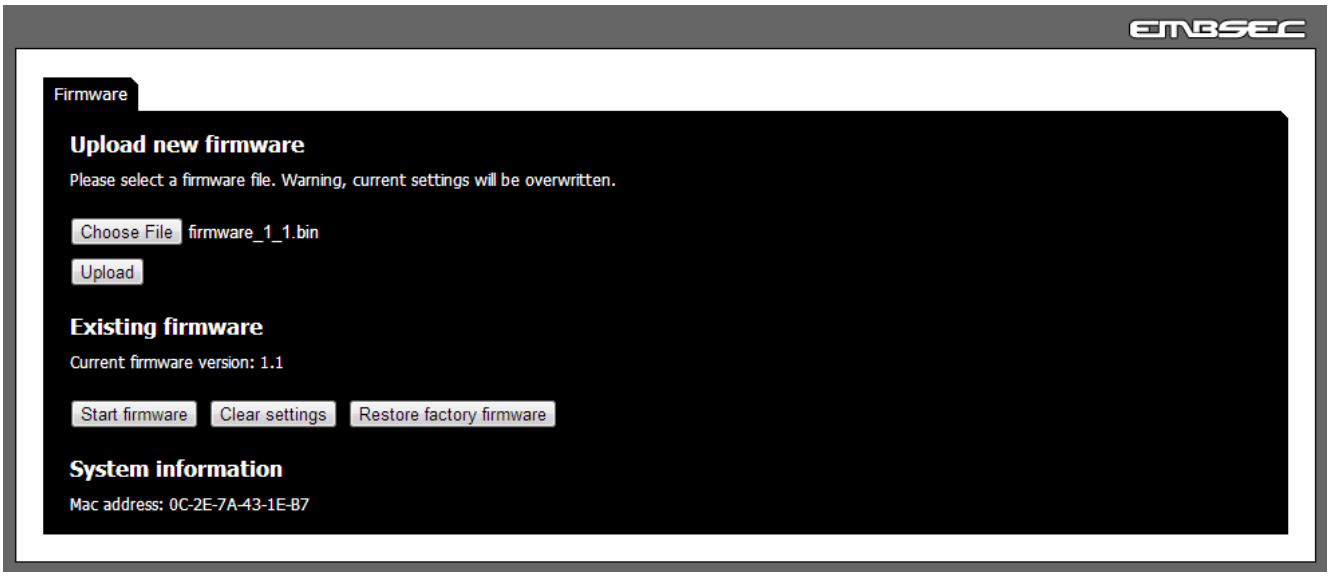
1. Open the *Firmware update* sub-tab in the *Installation and configuration* tab. Current firmware version is displayed.
2. Press the *Update firmware* button to stop the firmware and enter the system bootloader.



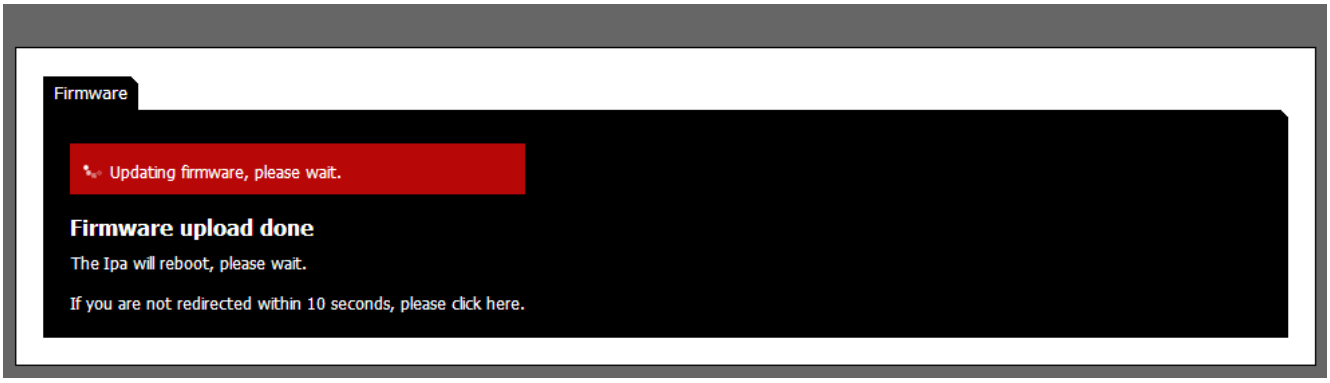
3. In the bootloader, you have the option to upload a new firmware, clear all settings (restore factory settings) and restore factory firmware.



4. To restore factory settings, press *Clear settings* button. Press *Start firmware* to start the IPA firmware again.
5. To upload a new firmware, press *Choose File* button and navigate to the location of the firmware file on your hard drive. When a file is selected the file name is displayed next to the button. Uploading a new firmware will erase all alarm and configuration settings.



6. Press *Upload* button. The firmware file will be uploaded to the vFence F-501. When the file is uploaded, the unit will replace the firmware and then reboot the system with the new firmware.


Firmware
Updating firmware, please wait.
Firmware upload done
The Ipa will reboot, please wait.
If you are not redirected within 10 seconds, please click here.

7. After the reboot the firmware settings page will be shown again.
8. Press *Start firmware* button to restart the IPA with the new firmware.

5.3.6. Restart after hardware reset

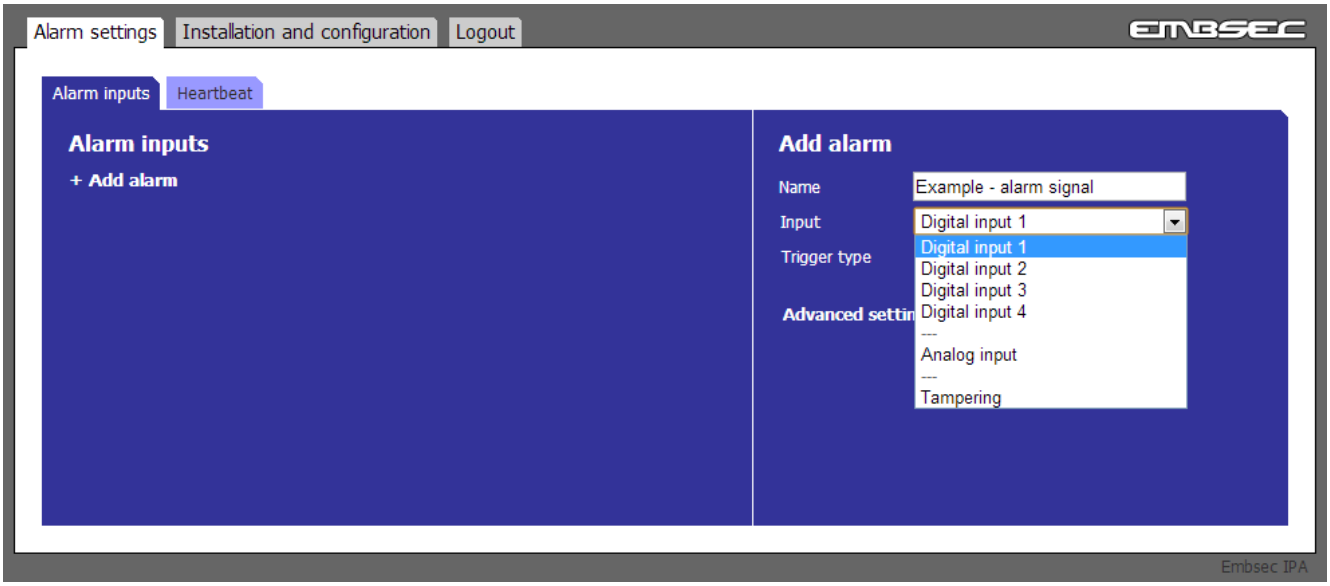
1. The unit will start in bootloader.
2. If there is any issue with the firmware, please restore factory firmware by pressing *Restore factory firmware* button.
3. Press the *Start firmware* button to restart the unit with the factory default IP address and login.

5.4. Alarm settings

All alarm settings are made in the *Alarm inputs* sub-tab in the *Alarm settings* main tab. The IPA works on the principle "Alarm - Action". This means that alarms are created based on all types of input signals. For each alarm it is possible to create one or more actions. The actions can be network alarm message or to trigger a relay.

5.4.1. Digital input alarms

1. Go to the *Alarm inputs* sub-tab in the *Alarm settings* main tab.
2. Press + *Add alarm* to create an event. Input fields appear on the right.
3. Enter a unique alarm name.
4. From the *Input* dropdown menu, choose the digital input that corresponds to the electrical connection on the IPA.



5. Choose *Trigger type* from the dropdown menu.

High	The alarm is enabled when the input voltage is "high" according to section 1.2.
Low	The alarm is enabled when the input voltage is "low" according to section 1.2.
Rising edge	The alarm is enabled when the input voltage is changed from "low" to "high" according to section 1.2.
Falling edge	The alarm is enabled when the input voltage is changed from "high" to "low" according to section 1.2.
Pulse frequency	The IPA measures the frequency at which the input changes between "low" and "high" according to section 1.2.The alarm is enabled if the frequency exceeds or falls below desired limits.

Below is separate descriptions on how to proceed depending on trigger type.

High / Low / Rising edge / Falling edge alarm

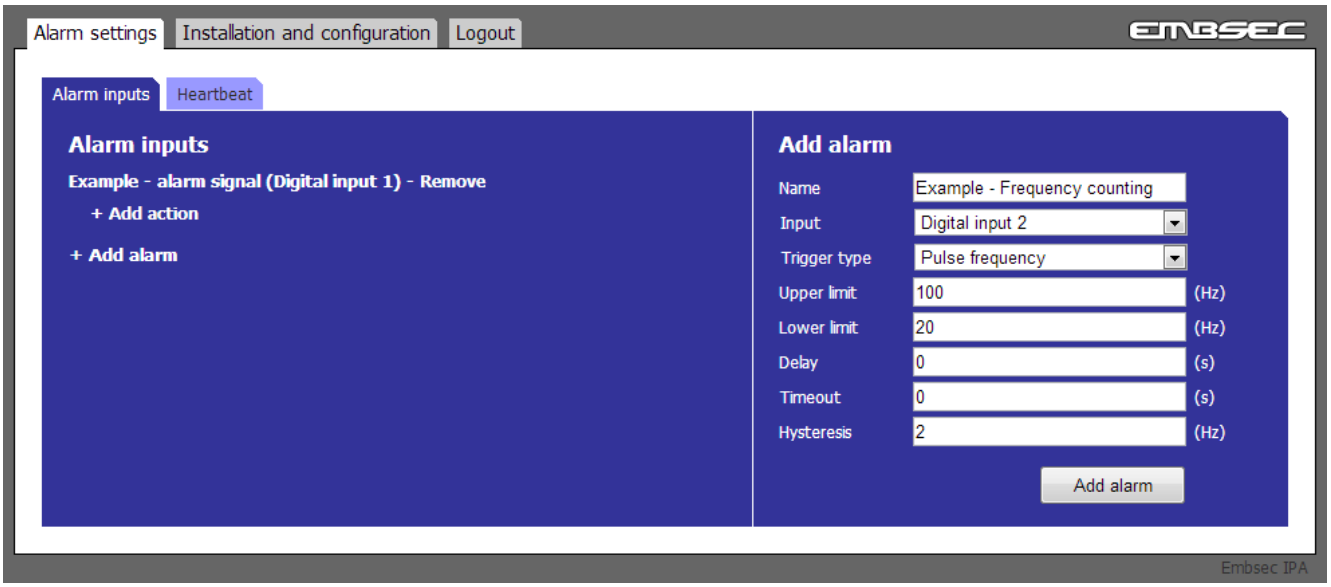
6. No extra settings are needed for the alarm. Go to step 8.

Pulse frequency

6. Set *Upper limit* for the pulse frequency. Maximum value is 2500 Hz.
7. Set *Lower limit* for the pulse frequency. Minimum value is 0.2 Hz.

8. This step describes advanced settings. These optional settings can be used to change the alarm behavior depending on the application. Different advanced settings are shown depending on trigger type.

Alarm delay	Alarm delay specifies the time for which the alarm conditions must be continuously fulfilled before the alarm is enabled. Default value is 0 seconds, maximum is 120 seconds.
Timeout	Timeout specifies the time before the alarm is disabled after the alarm conditions are no longer met. Default value is 0 seconds, maximum is 120 seconds.
Hysteresis	Hysteresis is used to avoid unstable alarm conditions when the pulse frequency is close to the limit values. The hysteresis specifies the reset value for the upper and lower limits. If no value is set or if the value is set to 0, the default hysteresis value of 1% will be used.

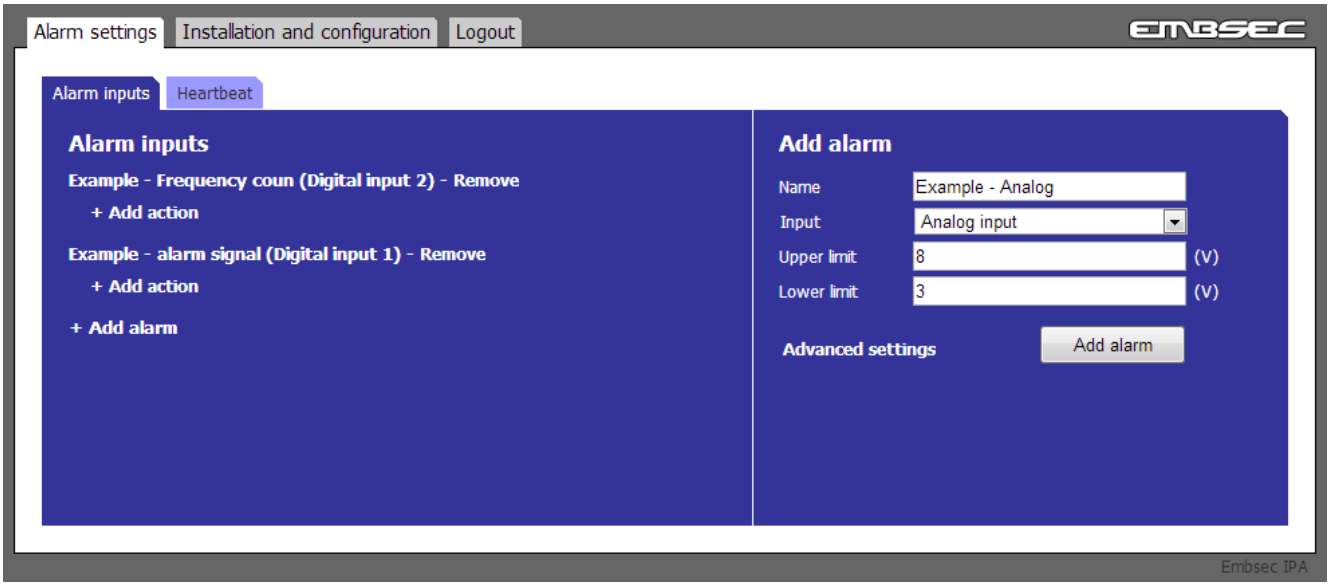


9. Press the *Add alarm* button to save the alarm event.
10. Repeat step 2 to 9 for all digital input alarms.

5.4.2. Analog input alarms

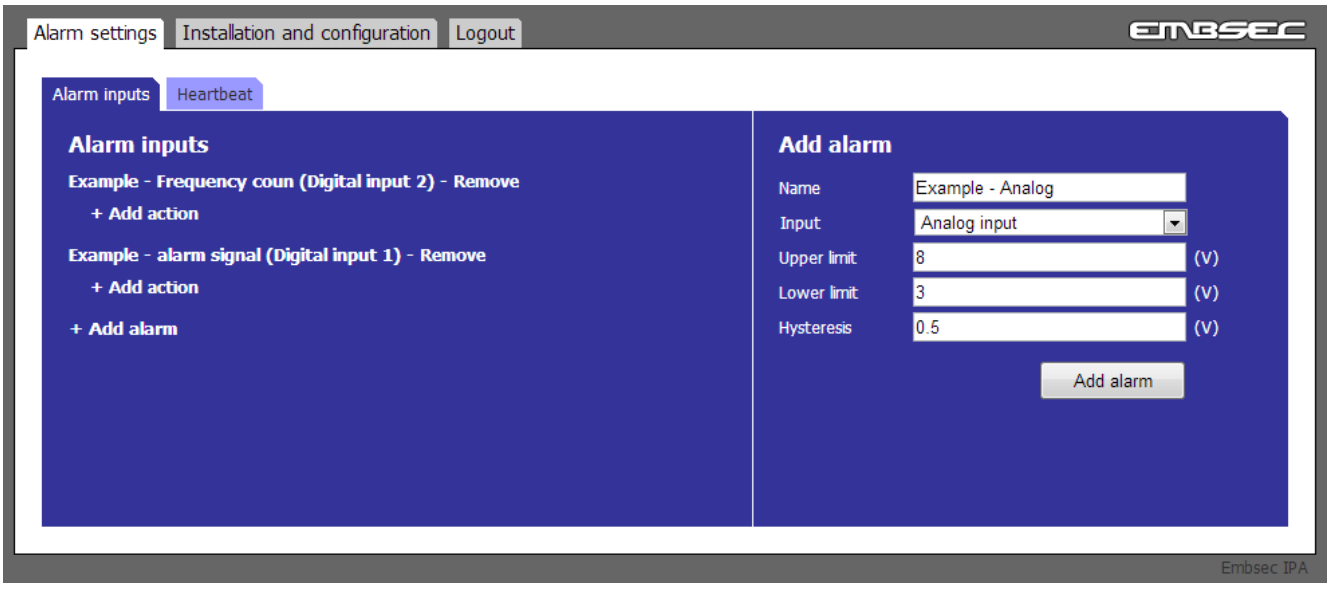
1. Go to the *Alarm inputs* sub-tab in the *Alarm settings* main tab.
2. Press + *Add alarm* to create an event. Input fields appear on the right.
3. Enter a unique alarm name.
4. From the *Input* dropdown menu, choose *Analog input*.

5. Set *Upper limit* for the measurement. Units and limits are according to I/O configuration in Section 5.3.2 .
6. Set *Lower limit* for the measurement. Units and limits are according to I/O configuration in Section 5.3.2 .



7. This step describes advanced settings. This optional setting can be used to change the alarm behavior depending on the application.

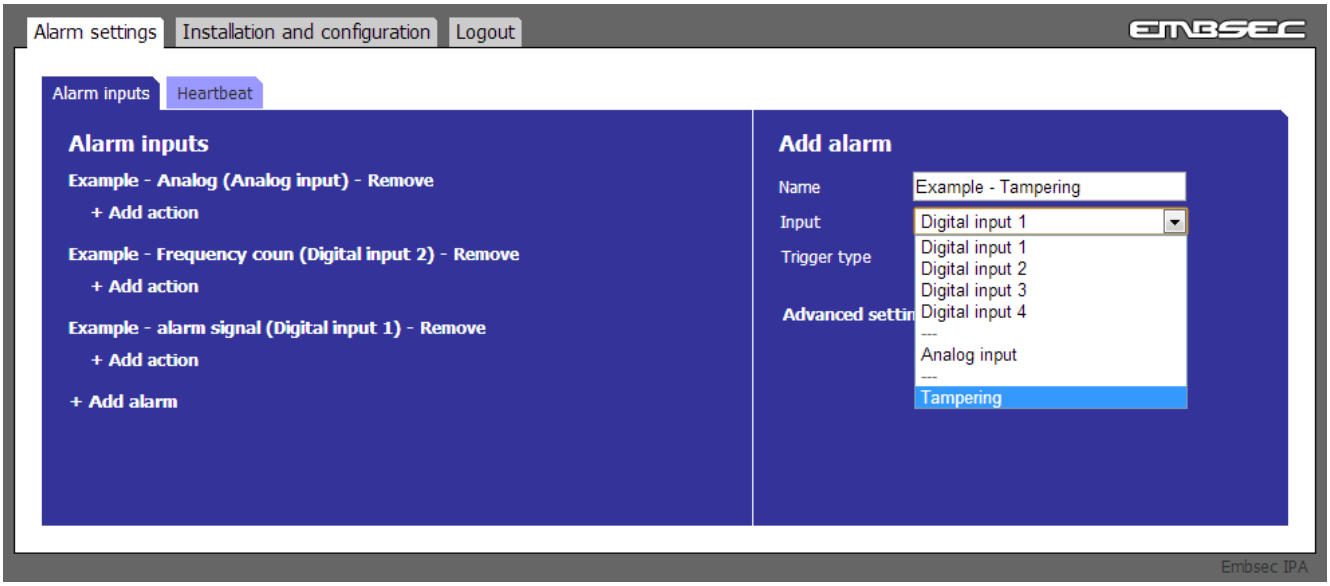
   Hysteresis — Hysteresis is used to avoid unstable alarm conditions when the measurement value is close to the limit values. The hysteresis specifies the reset value for the upper and lower limits. If no value is set or if the value is set to 0, the default hysteresis value of 1% will be used.



8. Press the *Add alarm* button to save the alarm event.

5.4.3. Tampering alarm

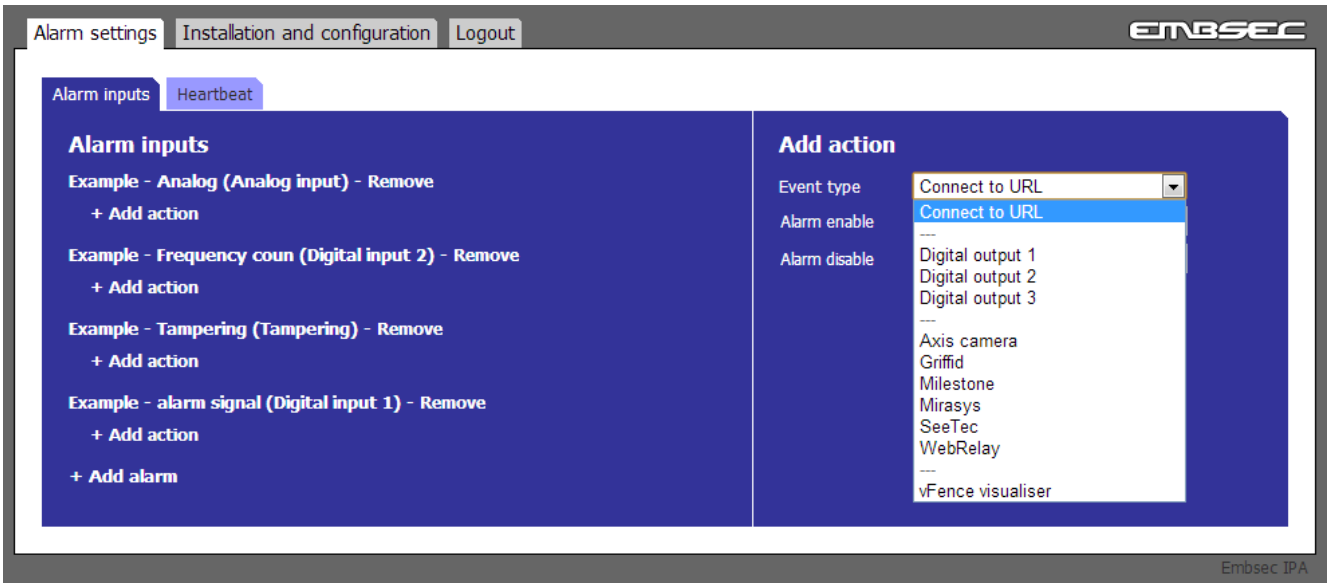
1. Go to the *Alarm inputs* sub-tab in the *Alarm settings* main tab.
2. Press + *Add alarm* to create an event. Input fields appear on the right.
3. Enter a unique alarm name.
4. From the *Input* dropdown menu, choose *Tampering*.



5. Press the *Add alarm* button to save the alarm event.

5.4.4. Create alarm actions

1. Press + *Add action* under the desired alarm. Input fields appear to the right.
2. Choose action type from the *Event type* dropdown menu.



Connect to URL Connect to URL is used to create any type of network alarm. This allows to have one URL request at alarm enable and one URL request at alarm disable.

Digital output 1-3	This turns the selected digital output on at alarm enable and turns it off at alarm disable.
Partner list	The products listed have a built-in wizard in the IPA that creates the specific URL request needed for the application. This list is continuously expanding. Please refer to separate documents regarding integration of these products.
vFence Visualiser	This wizard creates an URL request used in combination with Embsec software vFence Visualiser.

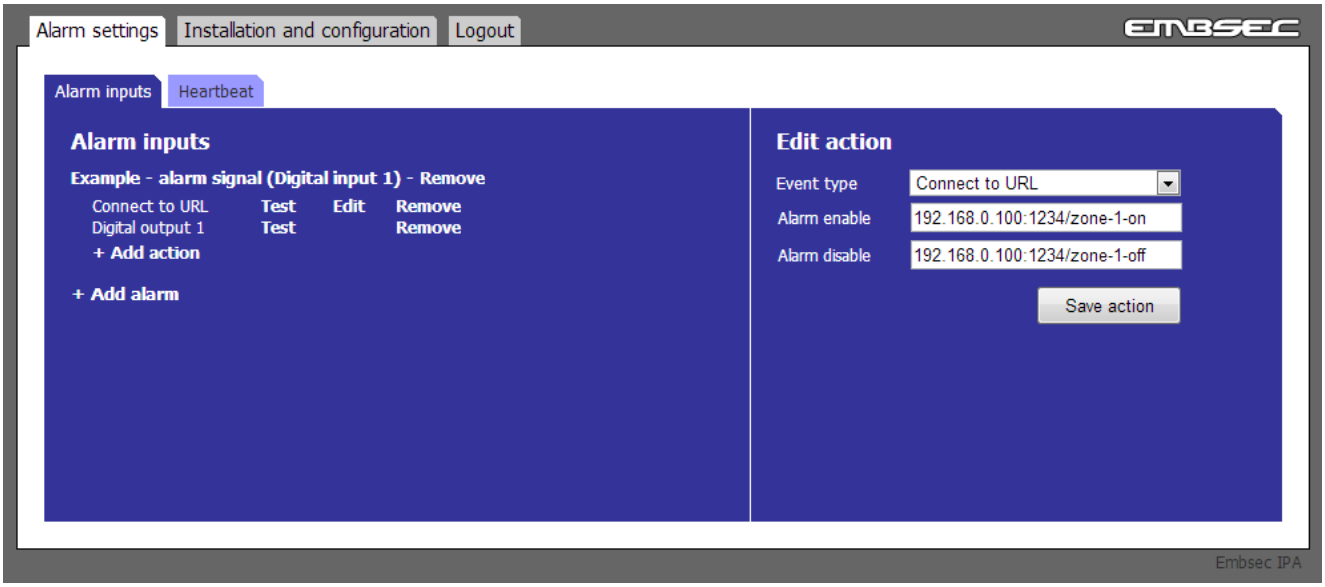
3. Fill in required data fields for the selected Event type.
4. Press the *Add action* button to save the action.
5. Press *Test* next to the action for an alarm to test the action.
6. Repeat step 1-5 for each alarm.

5.4.5. Edit and remove alarms

1. Edit an alarm by pressing the alarm name. The alarm settings appear to the right.
2. When the alarm settings are changed, press the *Save alarm* button to save the changes. Pressing any other link will discard all changes.
3. Remove an alarm by pressing the *Remove* link next to the alarm name. Removing an alarm cannot be undone.

5.4.6. Edit and remove actions

1. Edit an URL request action by pressing *Edit* next to the action. Digital output actions cannot be edited. The input fields appear to the right.

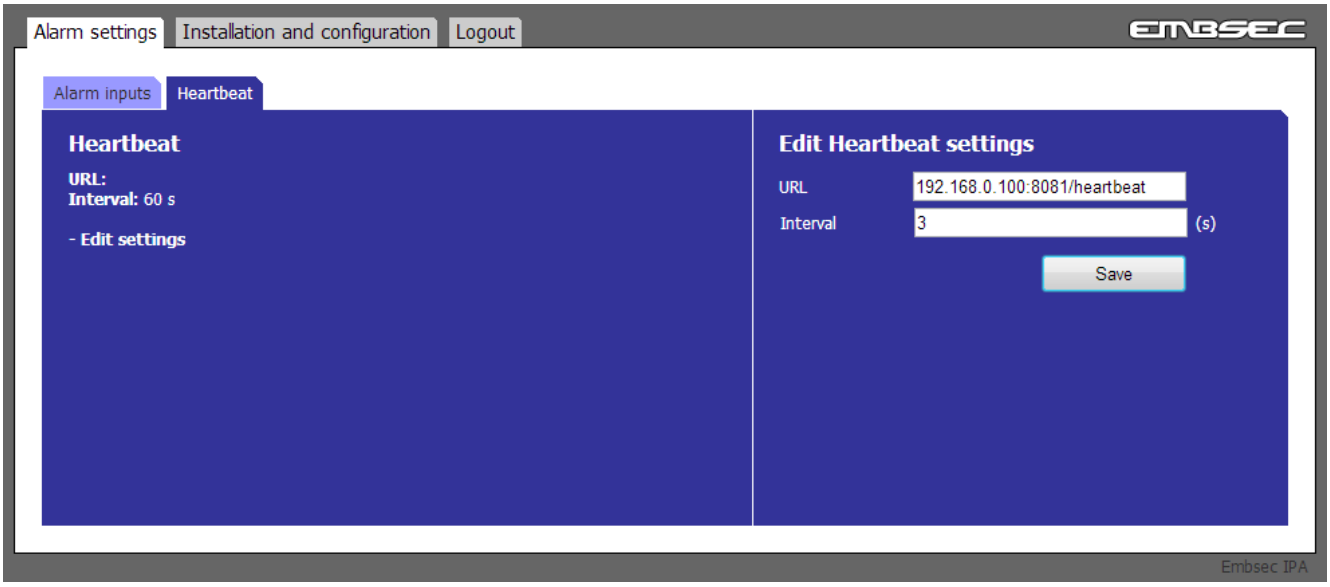


2. When the action settings are changed, press the *Save action* button to save the changes. Pressing any other link will discard all changes.
3. Remove an action by pressing the *Remove* link next to the action name. Removing an action cannot be undone.

5.4.7. Heartbeat

The heartbeat indicates that the IPA is alive and is working. It is used to detect cable break and product malfunction by periodically send a short message to the server. Server software to receive heartbeats is necessary.

1. In the Alarm settings tab, open the Heartbeat sub tab
2. Press "Edit settings". Input fields appear on the right.
3. Enter desired URL for heartbeat, for example the VMS server.
4. Enter desired time interval between heartbeats.



5. Press the save button to confirm the settings.

5.5. Logout

1. Press the "Logout" tab in the top menu.
2. You will automatically be logged out if anybody log in from another computer.

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